Religiousness and the Trajectory of Self-Rated Health Across Adulthood

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This study evaluates the association of religiousness with the growth parameters characterizing changes in self-rated health during adulthood (ages 20-94 years). Even after controlling for health behaviors, social support/social activity, and four of the Big Five, women who were highly religious in 1940 had higher mean self-rated health throughout their lifespan, slower rates of linear decline, and less pronounced cascades than did less religious women. For men, the associations of religiousness with the growth parameters underlying self-rated health were negligible. Results indicate that the association of religiousness with women's self-rated health may persist after controlling for mundane mediators and that the association of religiousness and self-rated health is not an artifact of the association between religiousness and the Big Five.

Keywords: religion; health; personality; longitudinal; Terman; growth modeling

In recent years, social scientists have noted a link between religiousness and many measures of physical and psychological well-being (Koenig, McCullough, & Larson, 2001; Powell, Shahabi, & Thoresen, 2003). The possibility that religiousness is linked to health and well-being has attracted attention (Blaine & Crocker, 1995; Blaine, Trivedi, & Eshleman, 1998; McIntosh, Silver, & Wortman, 1993; Park, Cohen, & Herb, 1990; Ryan, Rigby, & King, 1993) and commentary (e.g., Cacioppo & Brandon, 2002; Diener & Clifton, 2002; Fredrickson, 2002; Funder, 2002; Pizarro & Salovey, 2002) from a variety of personality and social psychologists. Research indicates that people who are highly engaged in religious pursuits (e.g., who frequently attend religious services) or who report that religion is a central aspect of their lives tend to have slightly higher subjective well-being (Myers & Diener, 1995; Witter, Stock, Okun, & Haring, 1985), slightly fewer depressive symptoms (Smith,

McCullough, & Poll, 2003), and slightly longer lives (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000) than do their less religious counterparts.

In addition, investigators have found a positive association between religiousness and self-rated health in random samples of adults from the United States (Ferraro & Albrecht-Jensen, 1991) and in samples of adults from Canada (Veenstra, 2000), Finland (Hyyppä & Mäki, 2001), and Japan (Krause, Ingersoll-Dayton, Liang, & Sugisawa, 1999). Despite their simplicity (e.g., single-item self-ratings of one's health on a scale from *very poor* to *very good*), global assessments of health are scientifically interesting. These measures are robust predictors of health care use (Hansen, Fink, Frydenberg, & Oxhoj, 2002) and mortality in community-dwelling adults (Benyamini & Idler, 1999; Idler & Benyamini, 1997) and cancer patients (Fayers & Sprangers, 2002). Self-ratings of health are also psychologically interesting because they reflect complex judgments of individuals' overall

well-being that are based on an integration of self-knowledge regarding many domains of psychological, social, and physical functioning (Benyamini, Idler, Leventhal, & Leventhal, 2000; Idler, 1995; Idler, Hudson, & Leventhal, 1999; Krause & Jay, 1994). Benyamini et al. (2000) reported that self-assessments of health incorporate not only physical functioning and disease but also subjective well-being, positive emotion, energy, and social support (Benyamini et al., 2000; Okun & George, 1984). These findings suggest that global self-ratings of health, by virtue of their sensitivity to so many aspects of health and well-being, depict an important aspect of what the World Health Organization intended when it defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 1946, p. 100).

Studying Self-Rated Health as Interindividual Differences in Intraindividual Change

Self-rated health is not an invariant property of individuals: It changes as people age. Indeed, self-rated health may change in certain ways for some people (e.g., a steep age-related decline) and in other ways for other people (e.g., relative stability with age). Modern analytic techniques enable one to model these interindividual differences in intraindividual change. For example, with repeated measures of self-rated health on individuals over the adult life span, age-related changes in an individual's self-rated health might be described with a set of parameters reflecting mean differences in self-rated health (i.e., an intercept) along with one or more latent growth processes representing age-related changes. Consider the following linear model:

$$SRH_{ij} = \beta_{0j} + \beta_{1j}(age_{ij}) + r_{ij}. \qquad (1)$$

In this model, SRH_{ij} is person j's self-rated health at age i. The parameter β_{0j} represents person j's true self-rated health at a particular year in time, which is typically conceptualized as a mean level of self-rated health at a y intercept (Raudenbush, Brennan, & Barnett, 1995). The parameter β_{1j} represents the rate of linear change per year of age (or the growth rate) for person j. The variable r_{ij} represents the residual in person j's self-rated health score at time i that cannot be explained with person j's intercept and linear change estimates.

Variation in self-rated health, however, may not result simply from differences in mean self-rated health and linear change across the life span. We reported previously (McCullough & Laurenceau, 2004) that self-rated health across adulthood can be represented most efficiently with growth trajectories that also specify parameters for quadratic and cubic change:

$$SRH_{ij} = \beta_{0j} + \beta_{1j}(age_{ij}) + \beta_{2j}(age_{ij})^2 + \beta_{3j}(age_{ij})^3 + r_{ij}, \qquad (2)$$

with individuals possessing differing values for the mean, linear change, and quadratic change parameters (but not the cubic effect, which was essentially constant for all individuals). We also found slight differences in the longitudinal trajectories for men and women with men having slightly higher mean levels, but also slightly higher rates of linear decline, than did women. Nonetheless, the typical trajectory of self-rated health for men and women was relative stability until age 55 followed by accelerating declines through the remainder of the life span.

But even after controlling for gender, the shapes of people's growth trajectories remained remarkably diverse. This raises the possibility that traits like religiousness might explain some of the variation in the longitudinal trajectories of self-rated health. One might evaluate whether religiousness predicts individual differences in these growth parameters by estimating a set of between-person models or Level 2 models that take the form:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(religiousness)_j + u_{0j}. \qquad (3)$$

Equation 3 specifies estimation for β_{0j}, person j's mean self-rated health (or the y intercept) centered at the midpoint of the measurement interval; γ_{00}, the mean self-rated health for the entire sample; γ_{01}, the strength of the relationship between the between-persons differences in mean self-rated health and religiousness; (*religiousness*)$_j$, person j's religiousness score; and u_{0j}, a residual reflecting the difference between person j's mean self-rated health parameter estimate (β_{0j}) and the predicted value. Additional coefficients can be added to represent other individual difference predictors of β_{0j}, and additional equations can be used to predict individual differences in the other growth parameters (e.g., linear and quadratic change).

By viewing self-rated health over adulthood as the result of several latent growth parameters, the questions that one might ask about the links between religiousness and self-rated health become more sophisticated. For example, rather than simply asking whether religiousness is related to individuals' self-rated health at any particular point in time, we can ask whether religiousness, or some other trait, obtains its association with self-rated health by exerting an influence that is more or less constant over the lifespan. Alternatively, we can explore whether religiousness is associated with the rate at which self-rated health declines as people age, or even the rate at which self-rated health accelerates or decelerates over time.

*Explaining the Links of
Religiousness and Self-Rated Health*

Health behaviors. In studying the associations between religiousness and self-rated health, it is wise to investigate three classes of variables that might be partially responsible for their association. The first two of these three classes of variables refer to what psychologists have recently dubbed *mundane mediators* of the religion-health association (Joiner, Perez, & Walker, 2002). First, it is important to investigate health behaviors. Religions provide meaning systems and social structures that regulate behavior (including health-relevant behaviors involving food and substance use). By ascribing value to certain forms of behavior, religion helps people to establish goals to engage in certain behaviors (e.g., losing weight) and avoid other behaviors (e.g., drinking alcohol) that can promote physical health and well-being (Durkheim, 1951; George, Larson, Koenig, & McCullough, 2000; Idler, 1995). Indeed, religiousness seems to promote adherence to conventional wisdom about engaging in health-promoting behaviors such as exercise and drinking in moderation (Strawbridge, Shema, Cohen, & Kaplan, 2001). Moreover, insofar as people integrate self-knowledge about their health behaviors into their self-assessments (Benyamini et al., 2000), religious people may appraise their health more positively in part because they perceive that they take good care of themselves.

Social support and social activity. Second, it is important to investigate social support and social activity. Religions often integrate people into social networks that provide social support (Durkheim, 1951; George et al., 2000; Hummer, Rogers, Nam, & Ellison, 1999; Strawbridge et al., 2001), and the perceived availability of social support is protective against many psychological and physical maladies (Baumeister & Leary, 1995; House, Landis, & Umberson, 1988). Religious people tend to stay married and have higher marital quality (Mahoney, Pargament, Tarakeshwar, & Swank, 2001; Strawbridge et al., 2001), and marriage is a form of social support that is also relevant for health and well-being (Kiecolt-Glaser & Newton, 2001). Finally, providing social support to others also predicts health and well-being (Brown, Nesse, Vinokur, & Smith, 2003), and a recent study showed that the positive association of religiousness with self-rated health was partially mediated by volunteerism (Krause et al., 1999).

Conventional personality traits. Third, it is important to investigate conventional personality traits that are associated with self-rated health. Contemporary trait theorists have expressed concern that the associations of religiousness with other outcomes might be spuriously caused by the covariation of religiousness with higher order personality dimensions, such as those in the Big Five or Five Factor taxonomy (McCrae, 1999). Neuroticism is the most reliable Big Five correlate of self-rated health (Benyamini et al., 2000; Okun & George, 1984; Wasylkiw & Fekken, 2002; Watson & Pennebaker, 1989). Conscientiousness may be of secondary importance as a Big Five correlate of self-rated health (Wasylkiw & Fekken, 2002). The need to control for such health-relevant personality traits is particularly acute because some of them may also be related to religiousness. Conscientiousness, Extraversion, and Agreeableness are all associated positively, albeit weakly, with religiousness (Saroglou, 2002), and Conscientiousness in adolescence predicts religiousness in early adulthood (McCullough, Tsang, & Brion, 2003).

The Present Study

We conducted the present investigation to examine the association of religiousness with the development of self-rated health over the adult life span. In this study, we used random coefficient growth curve models to decompose repeated measures of self-rated health into latent parameters reflecting interindividual differences in intraindividual change. We then examined whether religiousness predicted the latent growth parameters underlying self-rated health both before and after controlling for a suite of health behaviors, several measures of social support and social activity, and four of the Big Five personality traits (viz., Conscientiousness, Extraversion, Agreeableness, and Neuroticism). Other studies have indicated that there are sex differences in religiousness (Stark, 2002), self-rated health (McCullough & Laurenceau, 2004), and the association of religiousness with some measures of health (McCullough et al., 2000), so we also explored the possibility of sex differences in the associations of religiousness with the growth parameters underlying self-rated health, although we did not have specific hypotheses regarding this issue.

METHOD

Participants

We used data from the Terman Life Cycle Study of Children With High Ability (Terman & Oden, 1947). The Terman study comprises data from 1,528 bright and gifted boys and girls (all of whom had intelligence quotients exceeding 135) from the state of California. The average birth year for children in the original sample was 1910. Since the study was initiated, participants have been recontacted for more than a dozen follow-up surveys.

The present study differs from others that have relied on the Terman data set to examine the personality-health connection in two important ways. First, although Friedman, Martin, and their colleagues (Clark, Friedman, & Martin, 1999; Friedman, Tucker, Schwartz, Martin, et al., 1995; Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995; Martin & Friedman, 2000) have done much to explain why personality factors in childhood and adulthood are related to longevity, little if any of this work has systematically examined self-rated health as a measure of well-being. Self-rated health is an important metric for health and well-being in its own right and independently of its value as a predictor of longevity. Second, only one published study on health and mortality using the Terman data of which we are aware has used religiousness (a single-item measure that participants completed in 1950) as a predictor of any measure of health (Clark et al., 1999).

For the present study, we used data from the 1,119 (57% male, 43% female) of the 1,528 original participants whose data were adequate for the multilevel analyses described below (viz., nonmissing data on all covariates and at least one measure of self-rated health) and who were at least 20 years old (*M* age = 29.6 years, *SD* = 3.6 years, range = 20-40 years) in 1940. As of 1940, these mostly White, middle-class adults were very well educated (approximately 99% had high school diplomas; 89% had at least some college experience, 70% had at least a bachelor's degree; 45% had at least a master's degree, and 8% had a doctorate or more) and most (65%) were married (31% were single and 3% were divorced).

Measures

Self-rated health. In 11 different surveys (1940, 1945, 1950, 1960, 1972, 1977, 1982, 1986, 1991, 1996, and 1999), participants completed a 5-point Likert-type item (e.g., "general health since 1940") to indicate their perceptions of their own health (where 1 = *very poor*, 5 = *very good*). The 1,119 participants completed a total of 7,570 such measures during the 59-year period. Because of the initial age differences in the sample, this 59-year measurement period incorporated observations from people aged 20 to 94.

Religiousness. As of 1941, approximately 45% of the participants were Protestant, 3% were Catholic, 5% were Jewish, 2% were "other," and 45% indicated "no church affiliation." We measured participants' degree of religiousness in 1940/1941 with a 4-item scale consisting of items measuring both the overt, behavioral manifestations of religiousness and the more private, attitudinal aspects. Participants indicated their degree of interest in religion with a single item using a 5-point scale (where

1 = *none* and 5 = *very much*). Second, they indicated how much they liked reading the Bible with a 3-point scale (where 1 = like, 2 = indifferent, and 3 = dislike; reverse-scored). Third, they indicated their agreement with the idea that giving children religious instruction is essential for the successful marriage using a 5-point scale (where 1 = *very essential* and 5 = *decidedly not desired*; reverse-scored). Fourth, participants indicated the number of religious activities in which they were involved (out of five possible activities). Similar items are widely interpreted as valid measures of religious commitment for samples consisting largely of people from Protestant and Roman Catholic backgrounds (Mockabee, Monson, & Grant, 2001). Internal consistency reliability was approximately alpha = .74, and the total scale score was correlated very highly with modern measures of religiousness in a sample of university students (McCullough et al., 2003).

Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Martin and Friedman (2000) combined items from two personality instruments that participants completed in 1940 to create measures of Conscientiousness (7 items), Extraversion (7 items), Agreeableness (11 items), and Neuroticism (17 items) that had adequate internal consistency (i.e., alphas ranging from .65 to .85). Martin and Friedman demonstrated that the scales created with these items produced the same factor loadings in the Terman data set as in a contemporary sample of adults and high correlations with scores from a modern inventory that measures conscientiousness, extraversion, agreeableness, and neuroticism (monotrait-heteromethod correlations ranging from *r* = .63 to .81). Thus, these scales appear to have adequate reliability and construct validity.

Body mass. We categorized participants into clinically meaningful weight-for-height categories using self-reported height and weight data from 1940 that allowed us to calculate the Quetelet index ([weight (lbs)/height (in)^2] × 703], also known as the body mass index (BMI). Based on the recommendations of the Centers for Disease Control (2004), we classified people with BMIs < 18.5 as underweight, people with BMIs between 18.5 and 25 as having normal weight, people with BMIs between 25 and 30 as overweight, and people with BMIs > 30 as obese. Of the 1,119 participants, approximately 5% were classified as underweight, 8% were classified as overweight, and 1% was classified as obese. These four body mass groups were represented with a set of three dummy variables representing underweight, overweight, and obesity. Thus, people of normal weight scored 0 on all three dummy variables.

Alcohol use. In 1940, participants described their alcohol use by choosing 1 of 5 options (from 1 = *I have never used liquor* to 5 = *alcohol is a problem; I drink periodically or steadily, am drunk fairly often, and attempts to stop have been unsuccessful*). Based on data from similar items in the 1950 and 1960 surveys, high alcohol use is a predictor of early death in this sample (Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995).

Adjustment difficulties. To measure participants' psychological adjustment difficulties, we combined participants' standard scores on three items. The first item was a rating of global adjustment difficulties. To create this item, Terman's research staff read a series of items related to participants' psychological adjustment from the 1940 survey and then assigned each participant a score to indicate their general adjustment (where 0 = satisfactory, 1 = some difficulty, and 2 = considerable difficulty). Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al. (1995) reported that a similar rating of adjustment difficulties from 1950 was a significant predictor of early death, so this variable does appear to capture health-relevant aspects of psychological adjustment. The second item was a 4-point rating of the seriousness of any recent life events that participants reported having recently experienced (1 = *slight* to 4 = *very high*). The third item was a 4-point rating of the extent of nervous symptoms that the participant suffered as a result of the recent stressful life event (0 = *none* to 3 = *nervous breakdown*). The mean of these three items had an internal consistency reliability of alpha = .82, and their sum performed better than any of the items individually as a predictor of other variables in the study, so we used the sum of the standard scores for these three items as our measure of psychological adjustment.

Social support and social activities. We measured social support and engagement in social activities with six single-item measures: (a) number of professional/ business organizations in which participants were involved (range = 0-8 or more), (b) number of offices held in organizations (range = 0-6), (c) number of avocational activities in which they participated (range = 0-8 or more), (d) number of service activities in which they participated (range = 0-8 or more), (e) marital status (0 = not married; 1 = married), and (f) whether the participant lived alone or lived with someone else (0 = lives alone; 1 = lives with someone else).

Analyses

We used the Hierarchical Linear Modeling (HLM) 5.04 statistical software package (Raudenbush, Bryk, Cheong, & Congdon, 2000) to conduct the longitudinal analyses. HLM is ideal for this application because it yields growth parameter estimates from incomplete longitudinal data (e.g., for participants who died prior to the last survey or who missed one or more surveys). Participants with relatively large amounts of missing data make relatively small contributions to the estimation of the mean trajectory components and their variances. HLM allows for missingness on outcome variables assuming that the data are missing at random (MAR; Schafer & Graham, 2002). MAR refers to a situation in which missingness is not related to scores on unobserved measurements, although missingness *can* be related to observed measurements (e.g., previous measures of self-rated health) or other covariates (e.g., religiousness, personality traits, or gender). In more practical terms, missingness at random is ignorable because it does not bias parameter estimates under maximum likelihood estimation (Schafer & Graham, 2002).

HLM enabled us simultaneously to fit (a) within-person longitudinal models for each of the 1,119 individuals that specified their self-rated health scores as resulting from smooth longitudinal trajectories that are created by a set of growth parameters and (b) a set of between-person models to account for individual differences in the growth parameters with the measures of religiousness and other between-person variables.

Level 1 or within-person models. In our previous work with these data (McCullough & Laurenceau, 2004), we found that the best fitting Level 1 model, corresponding to Equation 2 above, modeled self-rated health as a function of an intercept (centered on age 57, which was the midpoint of the age range in the sample), linear change, quadratic change, and cubic change with significant random effects for the intercept, linear change, and quadratic change parameters. To minimize the correlations between the three growth parameters, we used orthogonal polynomial coefficients to represent the linear, quadratic, and cubic effects (Hedeker, 2004). In this context, the intercept is interpreted as an individual's self-rated health at the middle of the measurement period—that is, age 57 (Raudenbush et al., 1995).

Level 2 or between-person models. The between-person (or Level 2) models were attempts to account for individual differences in the Level 1 β coefficients (i.e., the coefficients representing initial status, linear change, and quadratic change, but not cubic change because the latter parameter did not vary across persons) that described the trajectory of self-rated health across the 59-year age span. These models took the form:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}X_{1j} \ldots + \gamma_{0q}X_{qj} \ldots + u_{0j}. \qquad (4)$$

Equation 4 specifies estimation for β_{0j}, which captures individual differences in mean self-rated health; γ_{00}, the average mean self-rated health for the entire sample; γ_{01}, the strength of the relationship between the between-

persons differences in mean self-rated health and a measured variable X_1; X_{1j}, individual j's score on X_1 (with up to q total covariates); and u_{0j}, a residual reflecting between-persons differences in mean self-rated health that are not accounted for by γ_{00} and the q between-subjects predictor variables. With similar equations, we also attempted to account for between-persons differences in linear and quadratic change.

To examine the association of religiousness with these growth parameters, we specified a model in which gender (0 = female, 1 = male), religiousness (centered on the sample mean), the interaction of gender and religiousness (the product of the dummy-coded gender variable and the mean centered religiousness variable), the four personality traits (mean-centered), the health behavior variables (mean-centered, except for the dummy-coded BMI variables), and the social support/ social activity variables (continuous mean-centered variables; binary variables dummy coded) were used simultaneously as predictors of the intercept, linear change, and quadratic change parameters. We expressed the magnitude of the associations of religiousness with each of the growth parameters by converting the t values to effect size r values using the following formula (Hunter & Schmidt, 1990):

$$r = t/(t^2 + n - 2)^{1/2}. \tag{5}$$

We were interested in the extent to which religiousness predicted these growth parameters before controlling for the personality, behavioral, and social variables and while controlling them simultaneously.

RESULTS

Descriptive Statistics

The mean of all 7,570 measures of self-rated health was 4.27 ($SD = 0.81$). Means and standard deviations for major measures of personality, religiousness, and putative psychological and behavioral mediators appear in Table 1 along with the correlations between these variables. Religiousness was positively associated with gender (women were, on average, more religious than men, $r = -.12$), positively associated with Conscientiousness, Extraversion, and Agreeableness (rs = .14, .08, and .15, respectively), negatively associated with alcohol use ($r = -.30$), and positively associated with number of avocational activities and number of service activities (rs = .07 and .17, respectively; all ps < .05, all Ns = 1,128).

Personality Traits and Religiousness as Predictors of Growth Parameters

Table 2 shows the coefficients, standard errors, and t values that resulted from regressing the individual differ-

ences in mean self-rated health, the linear change in self-rated health, and the quadratic change in self-rated health on religiousness and the Gender × Religiousness interaction. The coefficients in the top half of Table 1 represent the associations of religiousness and the Gender × Religiousness interaction with gender as the only other covariate in the model. The coefficients in the bottom half of Table 2 represent the associations of religiousness and the Gender × Religiousness interaction with gender and all of the other variables listed in Table 1 controlled simultaneously. Therefore, the coefficients in the bottom half of Table 2 represent the *unique* associations of religiousness and the Gender × Religiousness interaction on the growth parameters underlying self-rated health. As one can see from simply comparing analogous coefficients in the top and bottom halves of Table 2, statistically adjusting the religiousness and Religiousness × Gender interaction terms for the personality, health behavior, and social support/social activity variables had negligible effects on their associations with the growth parameters underlying self-rated health. These results indicate that the association of religiousness with self-rated health was relatively independent of the other variables in the model. Nonetheless, we interpret the associations between religiousness and the Religiousness × Gender interaction as they appear at the bottom of Table 2—that is, at the more stringent level of statistical control.

Religiousness and self-rated health at age 57. The intercept value of 4.165593 in the Self-Rated Health at Age 57 column of the lower half of Table 2 indicates that an individual with values of 0 for all covariates would be expected to have a self-rated health value of 4.165593 at age 57. The coefficient for religiousness in this column indicates that for women (because the coefficient for gender took a zero value for women), mean self-rated health at age 57 would be expected to be 0.077 units above the intercept for each unit change in religiousness. The standard deviation of religiousness is 0.74, so we can conclude that women's self-rated health at age 57 is expected to increase by $0.077 \times 0.74 = 0.05698$ for each standard deviation change in religiousness. This association was small in magnitude, effect size $r = .06$.

The Sex × Religiousness coefficient estimates the gender difference in the association between religiousness and self-rated health at the y intercept. Because of the high correlation of religiousness and the Sex × Religiousness interaction ($r[1,128] = .71$, $p < .05$; see Table 1), this coefficient had a large standard error, but the impact of this coefficient on the estimated association of religiousness with individual differences in self-rated health for men is substantial enough that some effort is made to interpret it. The Sex × Religiousness coefficient

TABLE 1: Means, Standard Deviations, and Correlations of Major Study Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Sex (0 = female)	0.56[a]	0.50	—																
2. Religiousness	0.00	0.77	-.12	—															
3. Sex × Religiousness interaction	-0.05	0.53	-.05	.71	—														
4. Conscientiousness	0.00	3.92	.11	.14	.14	—													
5. Extraversion	0.00	4.00	-.07	.08	.04	-.07	—												
6. Agreeableness	0.00	5.62	-.18	.15	.09	.08	-.06	—											
7. Neuroticism	0.00	9.08	-.14	-.02	.02	-.23	-.09	-.14	—										
8. Adjustment difficulties	0.00	0.86	-.10	.04	-.01	-.04	-.04	-.06	.37	—									
9. Underweight (Y/N)	0.05[a]	0.22	-.11	.03	.00	-.04	.01	-.01	.05	.04	—								
10. Overweight (Y/N)	0.08[a]	0.28	.14	.00	-.02	-.03	.01	-.08	-.02	-.07	-.09	—							
11. Obese (Y/N)	0.01[a]	0.08	-.01	-.01	-.03	-.01	-.03	.00	.02	.00	-.03	-.03	—						
12. Use of alcohol	2.58	0.94	.26	-.30	-.20	-.16	.11	-.19	.06	.07	-.03	-.01	-.02	—					
13. # professional/business organizations	0.72	1.26	.14	-.03	-.02	.12	.01	-.07	-.07	-.02	-.05	.08	.06	.01	—				
14. # offices held in organizations	0.17	0.54	.07	.00	.00	.11	-.03	-.01	-.04	-.02	-.01	.02	.02	-.05	.42	—			
15. # avocational activities	2.27	2.13	-.03	.07	.03	.13	.07	.01	-.07	.01	.00	-.03	.01	-.03	.10	.00	—		
16. # service activities	0.60	1.06	-.09	.17	.14	.04	.14	.05	-.10	-.02	-.03	.01	.01	-.12	.16	.11	.11	—	
17. Married (Y/N)	0.65[a]	0.48	-.01	-.03	-.03	.07	-.12	-.02	-.12	-.05	.03	.07	-.01	-.06	.01	.07	.07	.07	—
18. Live with other (Y/N)	0.88[a]	0.33	-.05	.01	.00	-.01	-.01	.01	-.04	-.03	.02	.05	-.02	-.10	-.06	.05	.07	.04	.46

NOTE: Correlations > |.06| are statistically significant at $p < .05$.
a. Percentage of participants in this category.

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TABLE 2: Coefficients for Intercept, Religiousness, and the Sex × Religiousness Interaction Terms as Predictors of Growth Parameters in Self-Rated Health

Associations of Religiousness With Growth Parameters Underlying Self-Rated Health After Adjustment for Sex[a]

| | Mean Self-Rated Health (Centered on Age 57) | | | Growth Parameter | | | | | |
| | | | | Linear Change | | | Quadratic Change | | |
Predictor	Coefficient	SE	t	Coefficient	SE	t	Coefficient	SE	t
Intercept	4.031630	0.032539	—[b]	−0.014262	0.001334	−10.69**	−0.000185	0.000020	−9.34**
Religiousness	0.090096	0.038235	2.36*	0.004941	0.001470	3.36**	0.000059	0.000023	2.55**
Sex × Religiousness	−0.050125	0.052375	−0.96	−0.004422	0.002031	−2.18*	−0.000046	0.000032	−1.43

Associations of Religiousness With Growth Parameters Underlying Self-Rated Health After Adjustment for Sex and Other Covariates[c]

| | Mean Self-Rated Health (Centered on Age 57) | | | Growth Parameter | | | | | |
| | | | | Linear Change | | | Quadratic Change | | |
Predictor	Coefficient	SE	t	Coefficient	SE	t	Coefficient	SE	t
Intercept	4.165593	0.054050	—[b]	−0.013475	0.002235	−6.03**	−0.000153	0.000038	−4.03**
Religiousness	0.077229	0.038628	2.00*	0.003973	0.001515	2.62**	0.000070	0.000024	2.90**
Sex × Religiousness	−0.072381	0.051258	−1.41	−0.004623	0.001977	−2.34*	−0.000058	0.000032	−1.84

NOTE: For all t values, $df = 1,115$ in the top half of Table 2 and $df = 1,100$ in the bottom half of Table 2.
a. Regression coefficients are adjusted for sex.
b. Scale scores range from 1 to 5, so this significance test is not informative and therefore is not reported.
c. Regression coefficients are adjusted for sex, conscientiousness, extraversion, agreeableness, neuroticism, adjustment difficulties, underweight, overweight, obesity, use of alcohol, and the social support/social activity variables listed in Table 1.
*$p < .05$. **$p < .01$.

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of –0.072381 in the Mean Self-Rated Health column means that for men, the coefficient for religiousness is estimated to be 0.077229 – 0.072381 = 0.004848, which implies a trivially small 0.004848 increase in self-rated health at age 57 for each standard deviation unit change in religiousness. From these results, we can conclude that religiousness is related to individual differences in women's mean self-rated health across the adult life course but not men's.

Religiousness and linear change in self-rated health. The intercept coefficient for linear change (–0.013475) indicates that the typical individual experienced a linear decline in self-rated health of 0.013475 units per year (although this rate of change varied between persons). The coefficient for religiousness was 0.003973, thereby indicating that each unit increase in religiousness (for women) was associated with a 0.003973 increase in the rate of linear change, or a 0.002940 increase for every standard deviation unit increase in religiousness. This association was small in magnitude, effect size $r = .08$. The statistically significant Sex × Religiousness coefficient in the Linear Change column indicates that for men, the association of religiousness with linear change in self-rated health was weaker than it was for women (0.003973 – 0.004623 = –0.000650)—that is, only trivially different from zero.

Religiousness and quadratic change in self-rated health. The coefficient for quadratic change was –0.000153, thereby indicating that the linear decline in self-rated health that characterized the typical longitudinal trajectory actually became steeper over the lifespan. That is, for the average person, self-rated health cascaded downward with age. The coefficient for religiousness in this column indicates that when all other predictors in the model were centered on zero, the rate of deceleration in self-rated health was weaker (–0.000153 + 0.000070 = –0.00083) thus suggesting a less pronounced cascade in self-rated health, on average, for religious people. This association was small in magnitude, effect size $r = .09$.

The coefficient for Sex × Religiousness in the Quadratic Change column represents the extent to which the association of religiousness and quadratic change in self-rated health is expected to differ for men. When this coefficient (–0.000058) is added to the coefficient for religiousness (0.000070), the result is 0.000012, which implies that, for men, the relationship between religiousness and curvilinear change in self-rated health was negligible even though the gender difference in the association of religiousness with quadratic change in self-rated health was not statistically significant.[1]

To aid in interpretation, Panels 1 and 2 of Figure 1 display some expected longitudinal trajectories in self-rated health for men and women, respectively, as a func-

tion of religiousness. Panel 1 represents the expected longitudinal trajectories for a woman of average religiousness and women who score one standard deviation above and below the mean (controlling for all other predictors in the model). These trajectories demonstrate that religious differences in self-rated health for women are fairly modest until about age 65 but become more marked thereafter. Indeed, by age 94, a woman who scored one standard deviation above the mean in religiousness in 1940 would be expected to have a self-rated health score of 3.40, whereas a woman who scored one standard deviation below the mean for religiousness in 1940 would be 2.79—equivalent to a 0.61/0.74 = 0.75 standard deviation difference in self-rated health.

The curves for men who score at the mean on religiousness and one standard deviation above and below the mean tell a different story. For men, the trivial religious differences in the growth parameters underlying the longitudinal unfolding of self-rated health render these three curves nearly identical.

DISCUSSION

In recent years, social scientists have noted a positive relationship between religiousness and measures of self-rated health in samples from several countries. The present study was designed to advance this work in four ways. First, we used 11 waves of panel data so that we could decompose self-rated health into a set of growth parameters that described individuals' trajectories of self-rated health over the life span (Bryk & Raudenbush, 1992). In doing so, we were able to examine the associations of religiousness with the latent growth parameters underlying self-ratings of health. Second, in conducting these analyses, we controlled for health behaviors, measures of social support, and measures of social activity that might have been related both to self-rated health and religiousness. In this way, we were able to account for many of the mundane mediators that Joiner et al. (2002) identified as the potential explanations for relationships between religiousness and health. Third, we controlled for personality traits such as neuroticism and conscientiousness that might have influenced people's religiousness in adulthood as well as their self-rated health (e.g., McCullough et al., 2003; Saroglou, 2002). Fourth, we extended the existing work on religiousness and self-rated health by searching for gender differences.

Women's Religiousness and Self-Rated Health

Women who were highly religious in 1940 tended to have higher mean levels of self-rated health across the life course than did their less religious counterparts in keeping with recent findings (e.g., Ferraro & Albrecht-Jensen, 1991; Hyyppä & Mäki, 2001; Krause et al., 1999;
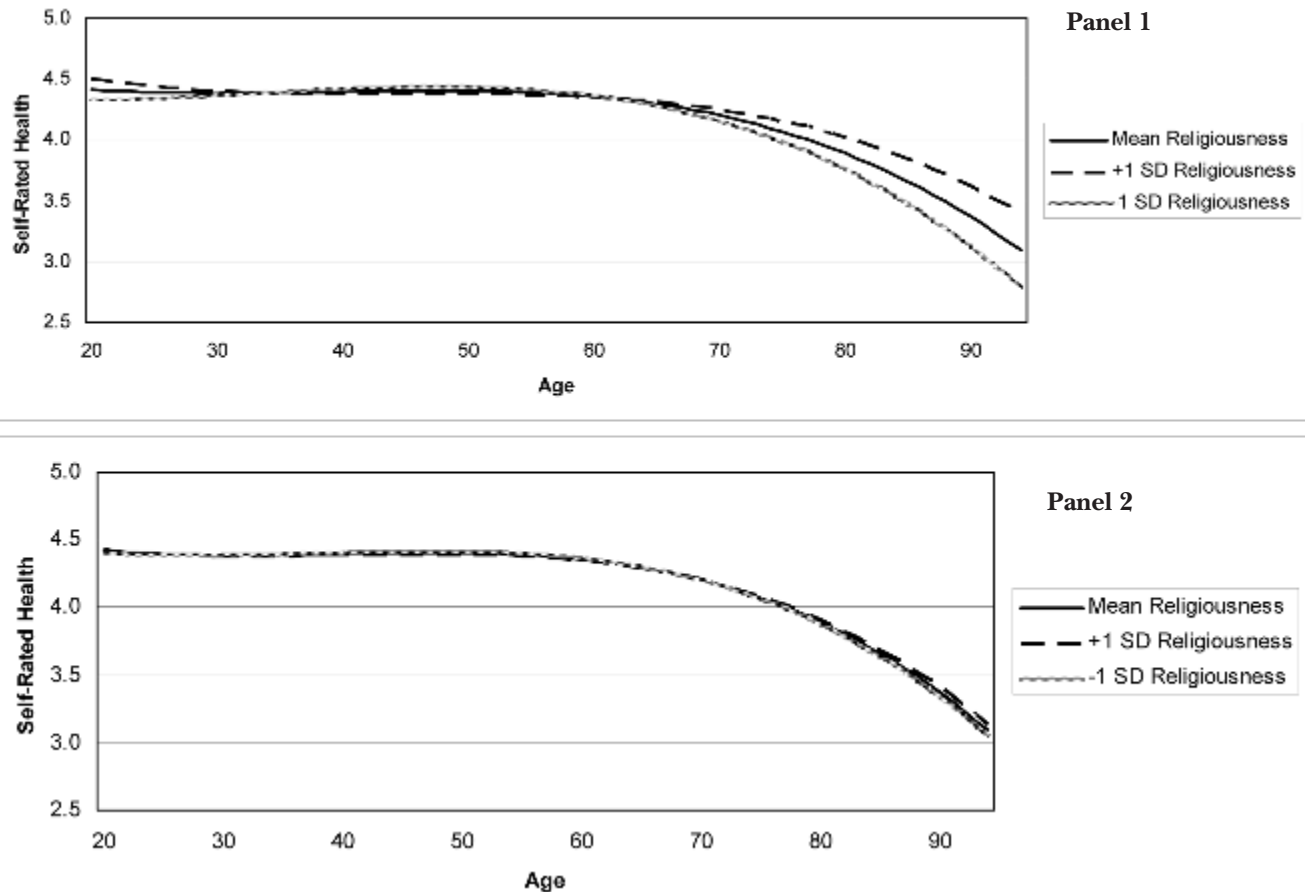
Figure 1   **Panel 1: The estimated trajectories of self-rated health for women scoring at the mean, one standard deviation above the mean, and one standard deviation below the mean on religiousness, controlling for all other covariates listed in Table 2. Panel 2: The estimated trajectories of self-rated health for men scoring at the mean, one standard deviation above the mean, and one standard deviation below the mean on religiousness, controlling for all other covariates listed in Table 2.**

Veenstra, 2000). In addition, religious women tended to experience slower rates of linear decline in self-rated health and less marked cascades in self-rated health as they aged. These religion-health associations were relatively independent of many measures of health behavior, social support and social activity, and four of the Big Five personality traits. The net effect of these religious differences in the growth parameters underlying self-rated health was that older age (i.e., age 65 and beyond) was a time in the life course in which religiousness had a particularly strong association with women's self-rated health. Because more than 75% of the women in the Terman study lived to be at least 65 years old, most of the women in this sample lived into the stage of life in which the religious gap in self-rated health was most pronounced.

To varying degrees, people consider nonphysical aspects of their lives when evaluating their health. Some people focus almost exclusively upon the presence or absence of physical symptoms or ailments, whereas oth-

ers consider their psychological well-being, satisfaction with their interpersonal lives, or even satisfaction with their spiritual lives (Benyamini et al., 2000; Idler, 1995; Idler et al., 1999; Krause & Jay, 1994). When people consider aspects of the self that are not subject to age-related decline, their self-rated health can stay relatively high even in the presence of age-related physiological and functional decline. Idler (1995) has suggested that religiousness may influence self-rated health by causing religious people to incorporate nonphysical aspects of their identities—specifically, their spiritual and religious lives—when evaluating their health (see also Idler et al., 1999). Spiritual and religious concerns persist for many people throughout the lifespan—even growing stronger for many people as they age (Argue, Johnson, & White, 1999). With age, religious women might therefore give greater cognitive weight to religious or spiritual aspects of their well-being (e.g., the positive affective quality of their relationships with God, the positive relationships with people in their congregations, or even a gift-like

view of their lives overall; Barusch, 1997) in assessing their health. If so, religious women's self-ratings of health may incorporate, *ceteris paribus*, more aspects of their selves that are performing satisfactorily (Idler, 1995), which might make them more optimistic about their health than would be warranted if self-rated health were based solely on the presence or absence of disease and physical disability. For this reason, religious women may perceive themselves to be in particularly good health even as they face the biological inevitabilities of aging.

Because we could not control for exercise, diet, and smoking—behaviors that have been associated with physical health and with religiousness (e.g., Strawbridge et al., 2001)—we left out some of the mundane mediators that might have been responsible for these relationships between women's religiousness and their self-rated health. Moreover, we were unable to control for sources of social support that participants were able to obtain specifically through their participation in religious organizations and institutions. Joiner et al. (2002) noted the paucity of studies on religion and health that examine the extent to which the health benefits of religion are due to social support that people receive specifically from participating in religious congregations. Unfortunately, we were not able to examine these variables either (working as we were with data collected more than 60 years ago), so it is possible that better control of mundane mediators or specifically religious forms of social support would cause the relationship between women's religiousness and their self-rated health to vanish. We view this as a high priority for future research on religiousness and health.

Men's Religiousness and Self-Rated Health

As Panel 2 of Figure 1 shows, religiousness had no appreciable association with the trajectories of men's self-rated health over the life course. This finding is consistent with research on religiousness and longevity (McCullough et al., 2000), which shows that religiousness is more strongly related to length of life for women than it is for men. This finding is also consistent specifically with work with the Terman data demonstrating that religiousness predicts length of life for women but not for men (Clark et al., 1999). In contrast, however, the small, negative association between religiousness and depressive symptoms (Smith et al., 2003) and the small, positive association between religiousness and subjective well-being (Witter et al., 1985) do not differ for men and women.

The observed gender difference in the links between religiousness and self-rated health merits greater attention in future work, for it suggests that religious women, but not men, possess psychological or social resources that may promote self-rated health. One possibility is that religious women, but not men, receive a health-promoting form of *spiritual* support by virtue of their religiousness that is quite distinct from the social support that they receive from nonreligious sources (cf. Joiner et al., 2002). The fact that women are, on average, more religious than are men in nearly all cultures (Stark, 2002) and throughout most of the life course (Argue et al., 1999; McCullough, Enders, Brion, & Jain, 2004) may mean that by the last few decades of the life course, the religious lives of relatively religious women may differ considerably and qualitatively from the religious lives of relatively religious men. Clearly, more research is needed to make sense of the qualities of men and women's religious lives that may explain the obtained gender differences in the links between religiousness and self-rated health.

Religiousness, Personality, and Self-Rated Health

Researchers investigating individual difference variables that are relatively new on the scene "owe readers the courtesy of mentioning how their variables relate (if at all) to the [variables in the Five Factor taxonomy]" (McCrae, 1999, p. 1,213). McCrae (1999) suspected that Openness was the key Five Factor correlate of religiousness, but more recent research suggests that Conscientiousness, Extraversion, and Agreeableness are stronger predictors of religiousness and that the correlation of religiousness with Openness is vanishingly small (Saroglou, 2002). Moreover, so little variation in religiousness is accounted for by the Big Five (probably no more than 5% to 7%) that many theorists have recommended conceptualizing religiousness as distinct from the Big Five (Paunonen & Jackson, 2000; Piedmont, 1999; Saucier & Goldberg, 1998).

In the present study, the associations of religiousness with four of the Big Five (Conscientiousness, Extraversion, Agreeableness, and Neuroticism) were also quite small and accounted for, at most, 4% to 5% of the variance in religiousness. Therefore, it is not surprising that statistically controlling for the Big Five had virtually no influence on the obtained associations between women's religiousness and the growth parameters underlying self-rated health. Of course, we were not able to control for Openness to Experience, but as Saroglou's (2002) meta-analytic review as well as our previous explorations of these data with a measure of Openness from childhood (McCullough et al., 2003) show, Openness is only trivially associated with religiousness, and its *unique* contribution to the prediction of religiousness hovers at about nil.

Thus, our results and those from other published studies argue convincingly that one should not assume that the associations of religiousness with third variables

(i.e., self-rated health) will disappear simply by controlling the superordinate personality traits in taxonomies such as those in the Five Factor model. Therefore, insofar as well-known personality traits themselves can be used as the foundation for causal theories about human behavior and mental processes (McCrae & Costa, 1995), religiousness may also be viewed as a motivator of certain behaviors and mental processes—self-ratings of health for women here being a case in point. Whether religiousness should be viewed as a bona fide cause of self-rated health remains to be seen, but what seems clear for now is that its association with self-rated health cannot be dismissed a priori as spurious.

Limitations and Directions for Future Work

Several limitations of the present study should be noted. First, the associations between women's religiousness and the growth parameters underlying self-rated health were small in magnitude (effect size rs ranging from .06 to .09). Associations of this magnitude appear to be the rule rather than the exception for the associations of religiousness with many measures of health and well-being (Diener & Clifton, 2002; McCullough et al., 2000; Smith et al., 2003; Witter et al., 1985). Of course, small associations are not automatically rendered unimportant simply because they are small (see Diener, Lucas, Oishi, & Suh, 2002; McCullough, Hoyt, & Larson, 2001), but the effect sizes should be kept in mind when interpreting these associations nonetheless.

Second, it should be noted that the Terman participants constitute a highly selective sample of intelligent, largely middle-class children who became, for the most part, well-educated Californians. As a result, these findings may not generalize adequately to the general population. However, all published studies involving the Terman data—now more than 100 in all—suffer from the same problem of representativeness, and it is important to keep in mind that many of the health-related findings emerging from studies with the Terman data have been replicated in more representative data sets. Moreover, the homogeneity of this sample in terms of socioeconomic status, ethnicity, and educational attainment means that a variety of alternative explanations for the obtained findings that rely on unmeasured differences in race, socioeconomic status, or geographic region can be ruled out.

A third limitation of the present study is that we measured religiousness, personality traits, health behaviors, and social support/social activity variables at only one point in time—when individuals were in early to mid adulthood. Had time-varying measures of these constructs been available, we could have investigated whether people's rates of change in religiousness were

also associated with rates of change in their self-rated health or whether people who are more religious at a particular point in time than is typical for them also have higher self-rated health at that point in time than is typical for them (Brennan & Mroczek, 2002).

As mentioned above, it would be useful to examine the associations of religiousness with the growth parameters underlying self-rated health in light of a wider range of putative psychological and behavioral mediators (e.g., smoking, diet, and exercise). Studies that enabled researchers to measure social support specifically derived from religious involvement would help to address Joiner et al.'s (2002) concern about the religion-health association, and studies that enabled researchers to measure people's satisfaction with nonphysical aspects of the self would also help to test directly Idler's (1995) hypothesis about religious people's tendencies to incorporate nonphysical aspects of self when evaluating their health. Such studies could be valuable specifically for shedding further light on the gender differences in the association of religiousness with self-rated health. It would also be useful to know whether the association of religiousness with self-rated health can be reproduced using clinicians' ratings of global health, or even physiological measures of physical health. If such findings can be reproduced with health data that are not strictly self-report in nature, then we might gain confidence that religiousness is associated with factors that may influence objective physical functioning (as suggested by Clark et al.'s (1999) finding that religious women in the Terman sample lived longer lives than did their less religious counterparts). If not, then we might gain confidence that religiousness influences self-rated health by changing people's self-perceptions or by altering their notions of what *healthy* means.

NOTE

1. As per the regression model in the bottom half of Table 2, the following variables (coefficients in parentheses) were significant ($p < .05$) predictors of mean self-rated health: conscientiousness (0.014422), neuroticism (–0.007450), adjustment difficulties (–0.172909), underweight (–0.223136), obesity (–0.329318), number of avocational activities (0.022068), and living with someone (–0.136414). The following variables were significant predictors of linear change in self-rated health: conscientiousness (0.000417), obesity (–0.025887), and alcohol use (–0.002545). The following variables were significant predictors of quadratic change in self-rated health: adjustment problems (–0.000035) and obesity (–0.000345).

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